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Mautino et al.

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(54) **RAILWAY CAR COUPLER AND KNUCKLE SYSTEM AND METHOD**

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B61G 3/06	(2006.01)
B61G 1/10	(2006.01)

(52) **U.S. Cl.**
CPC ***B61G 3/06*** (2013.01); ***B61G 1/10*** (2013.01)

(58) **Field of Classification Search**
CPC ... B61G 1/00; B61G 3/04; B61G 3/06; B61G 3/10
(Continued)

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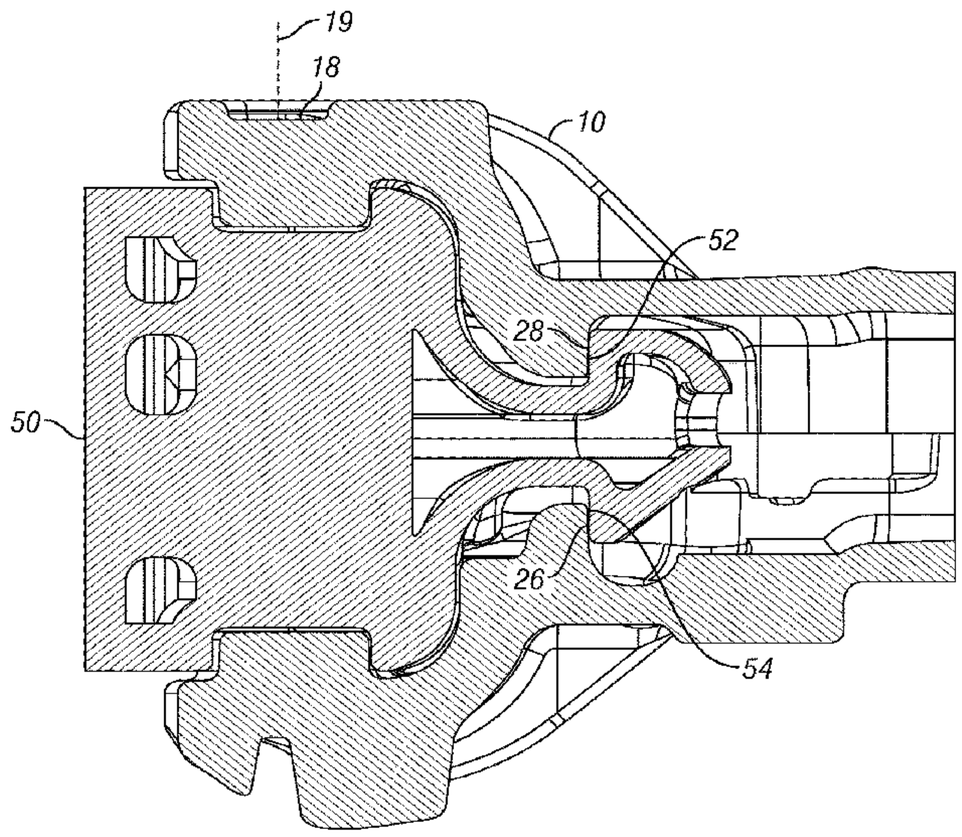
(57) **ABSTRACT**

A railway car coupler system includes a railcar coupler comprising a coupler head portion extending from a shank portion. The coupler head portion is configured to couple to a first coupler knuckle for coupling the railcar coupler to a second railcar coupler of an adjacent railcar. The coupler head portion comprises a coupler pivot pin hole for receiving a pivot pin for coupling the railcar coupler to the first coupler knuckle. The pivot pin hole has a longitudinal axis. The coupler head portion comprises top and bottom coupler pulling lugs each having a respective coupler pulling lug engagement face. At least one of the coupler pulling lug engagement faces of the top and bottom coupler pulling lugs is angled with respect to the longitudinal axis.

14 Claims, 7 Drawing Sheets



(58) **Field of Classification Search**
USPC ..... 213/75 R, 77, 100 R, 151, 152, 155
See application file for complete search history.

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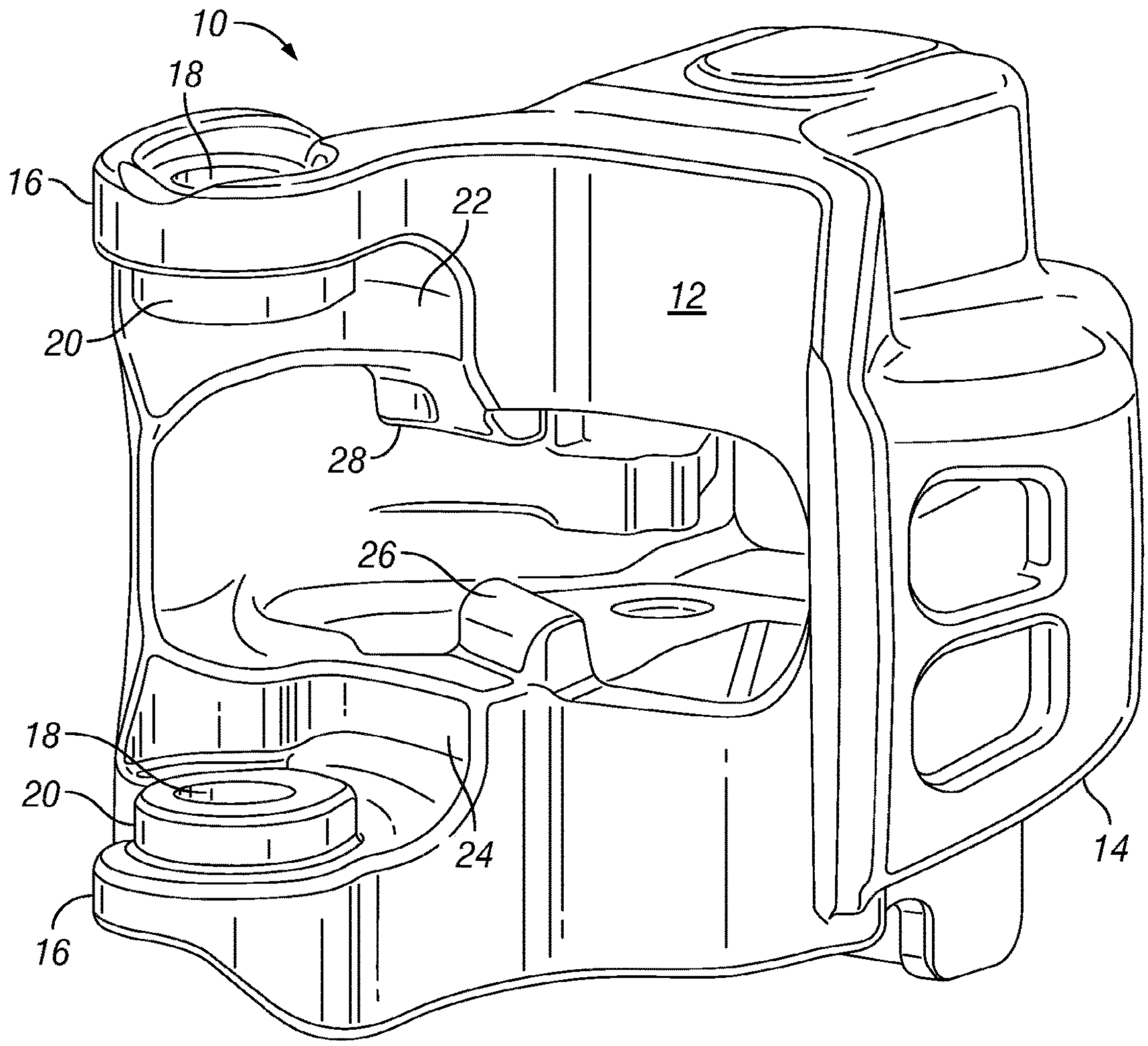

FIG. 1

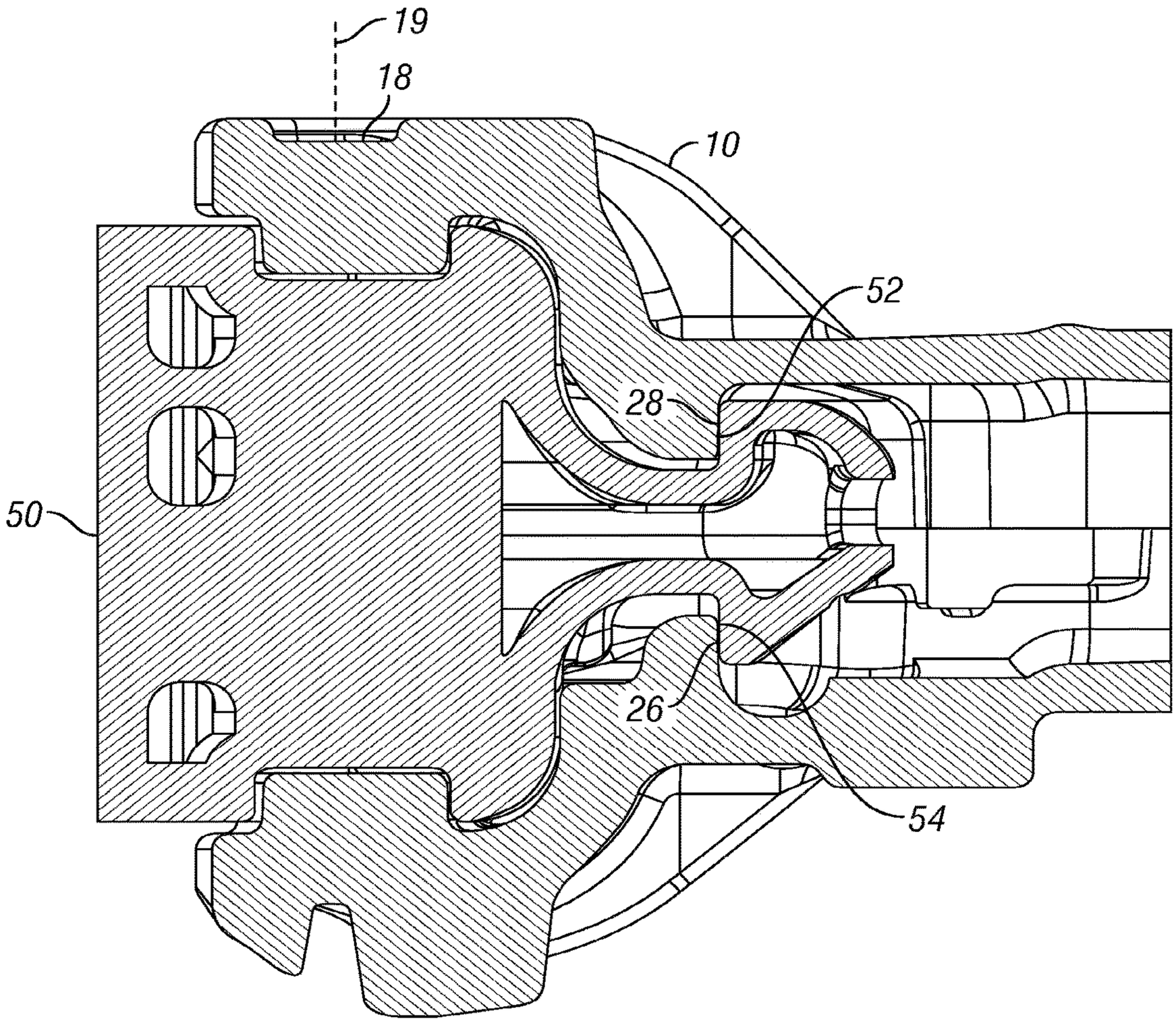

FIG. 2

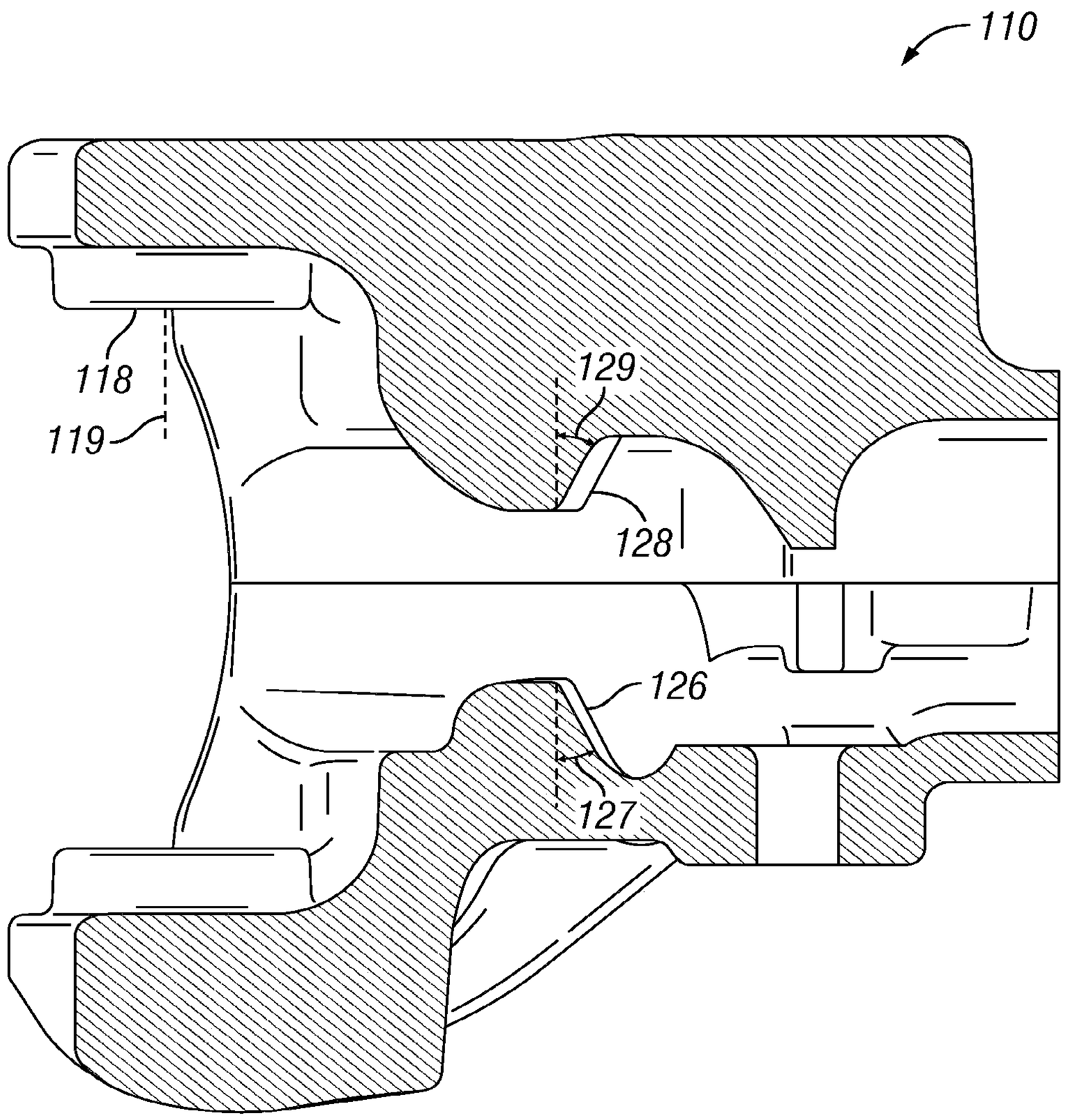

FIG. 3

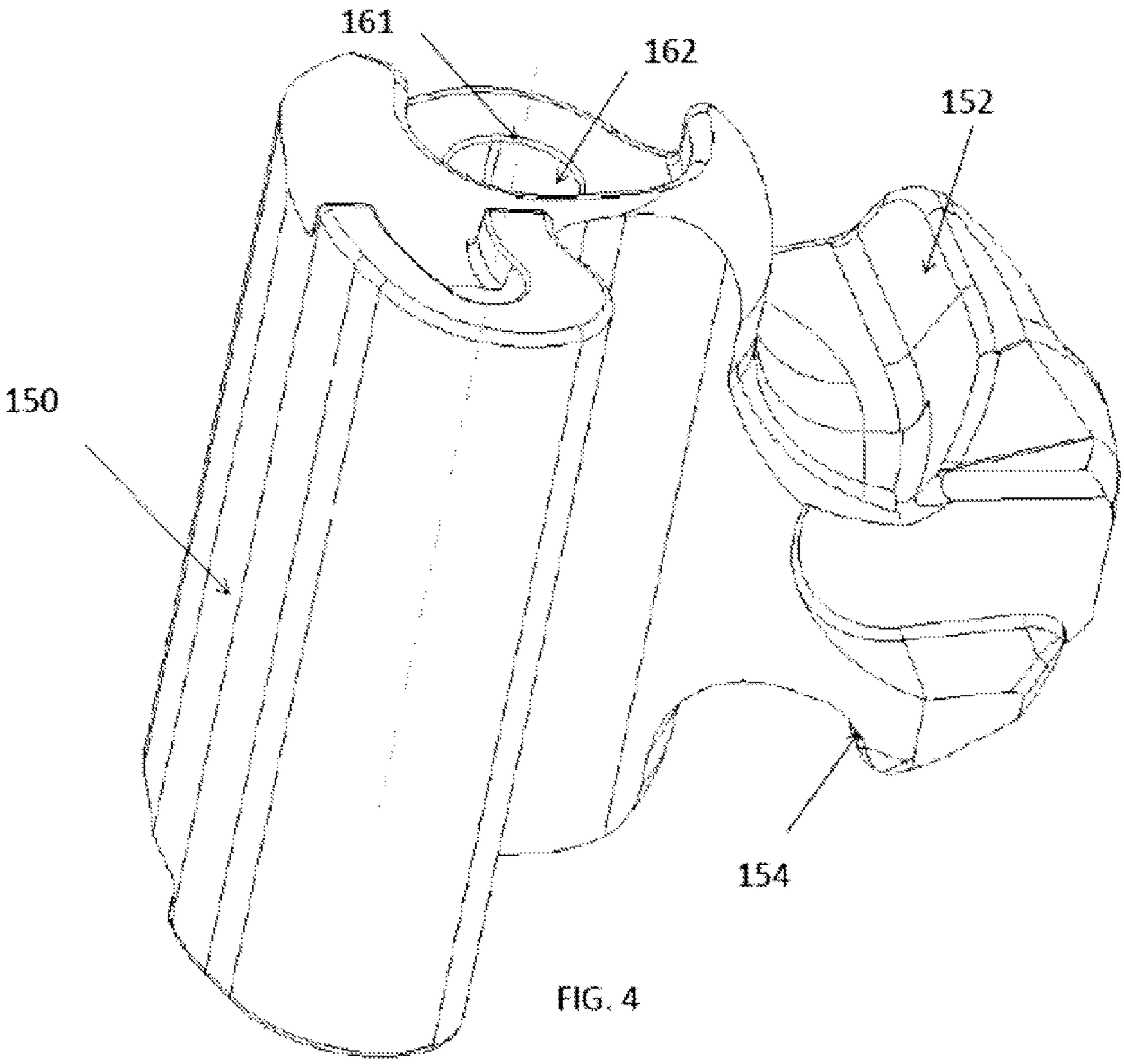

FIG. 4

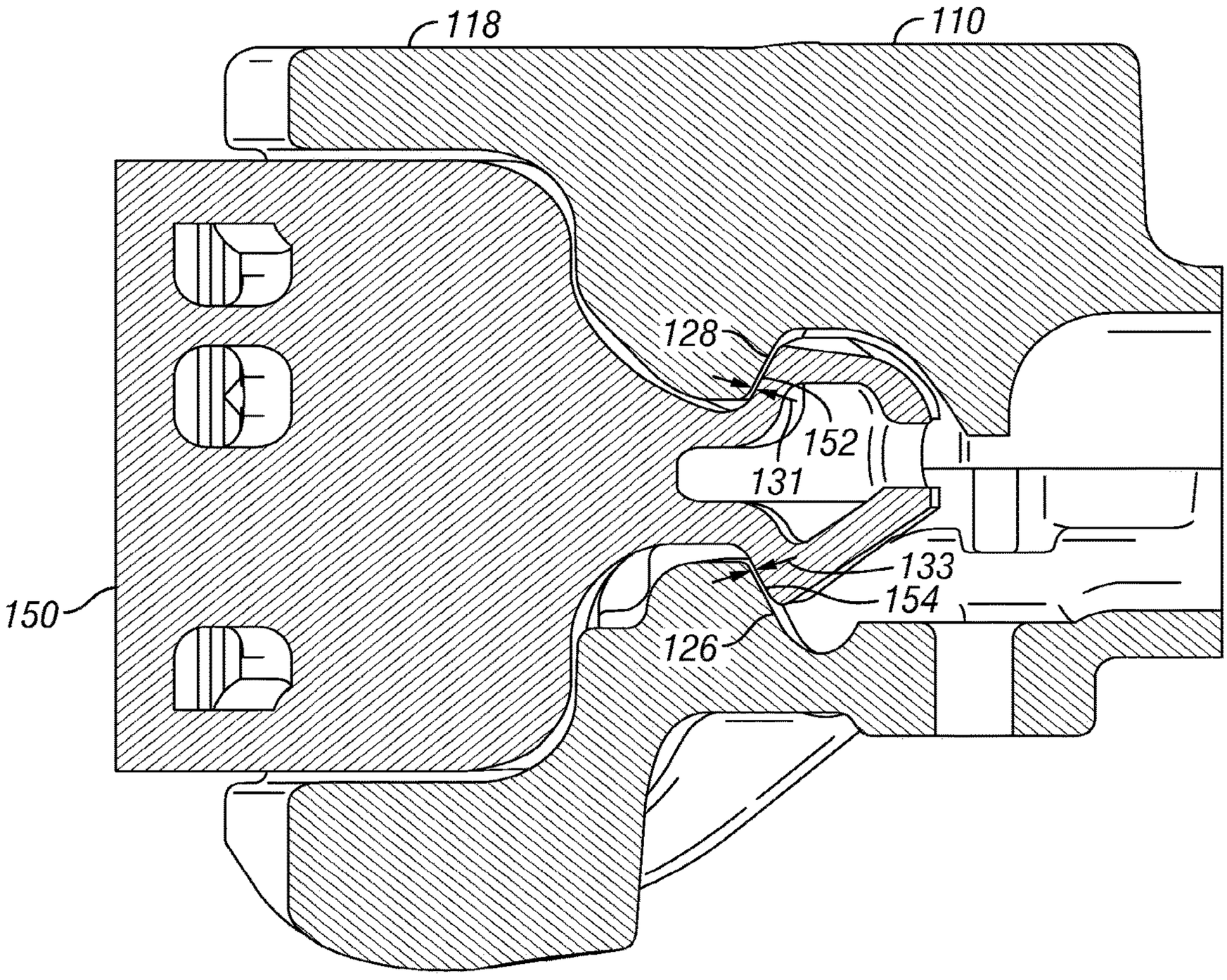

FIG. 5

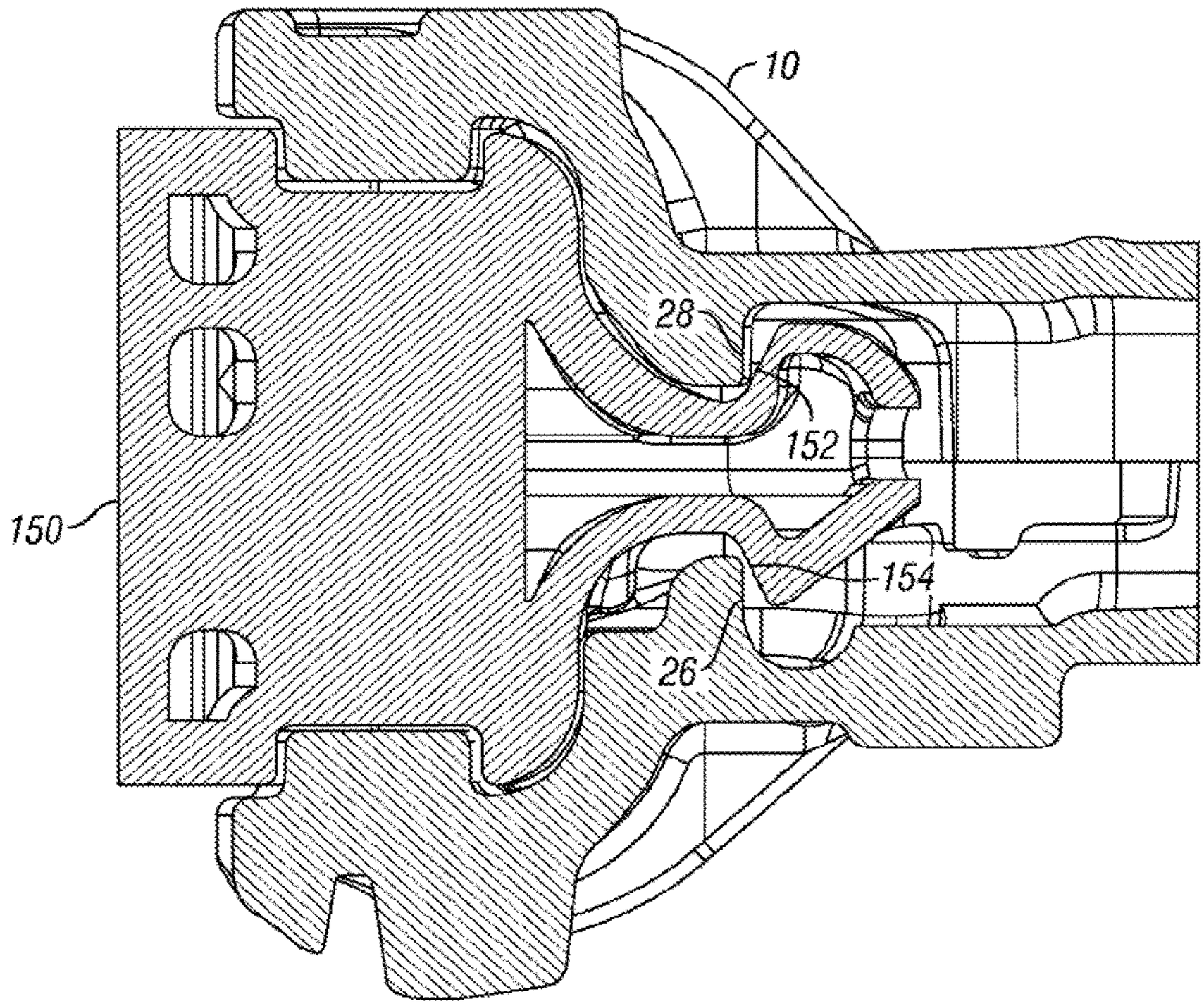

FIG. 6

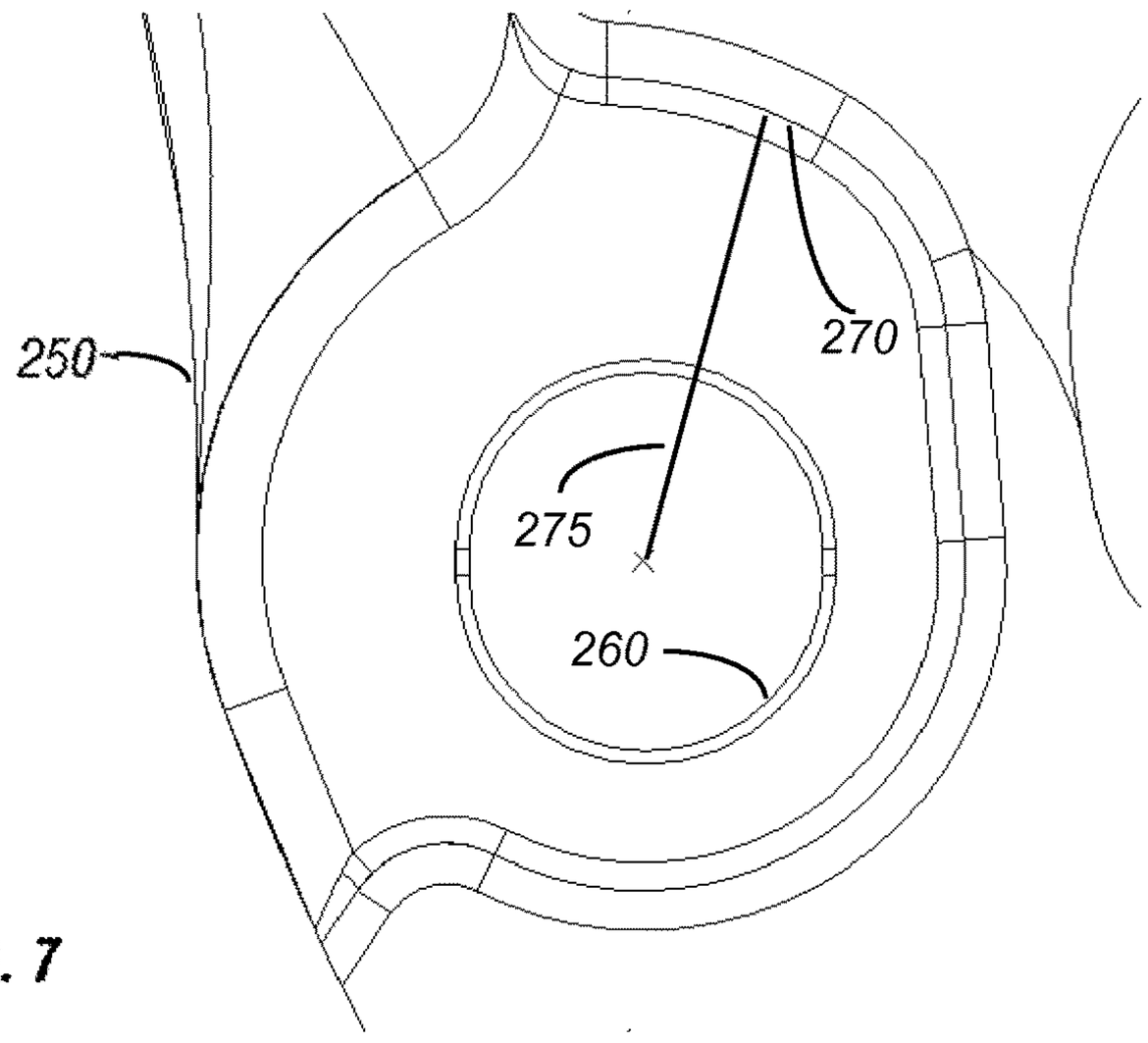

FIG. 7

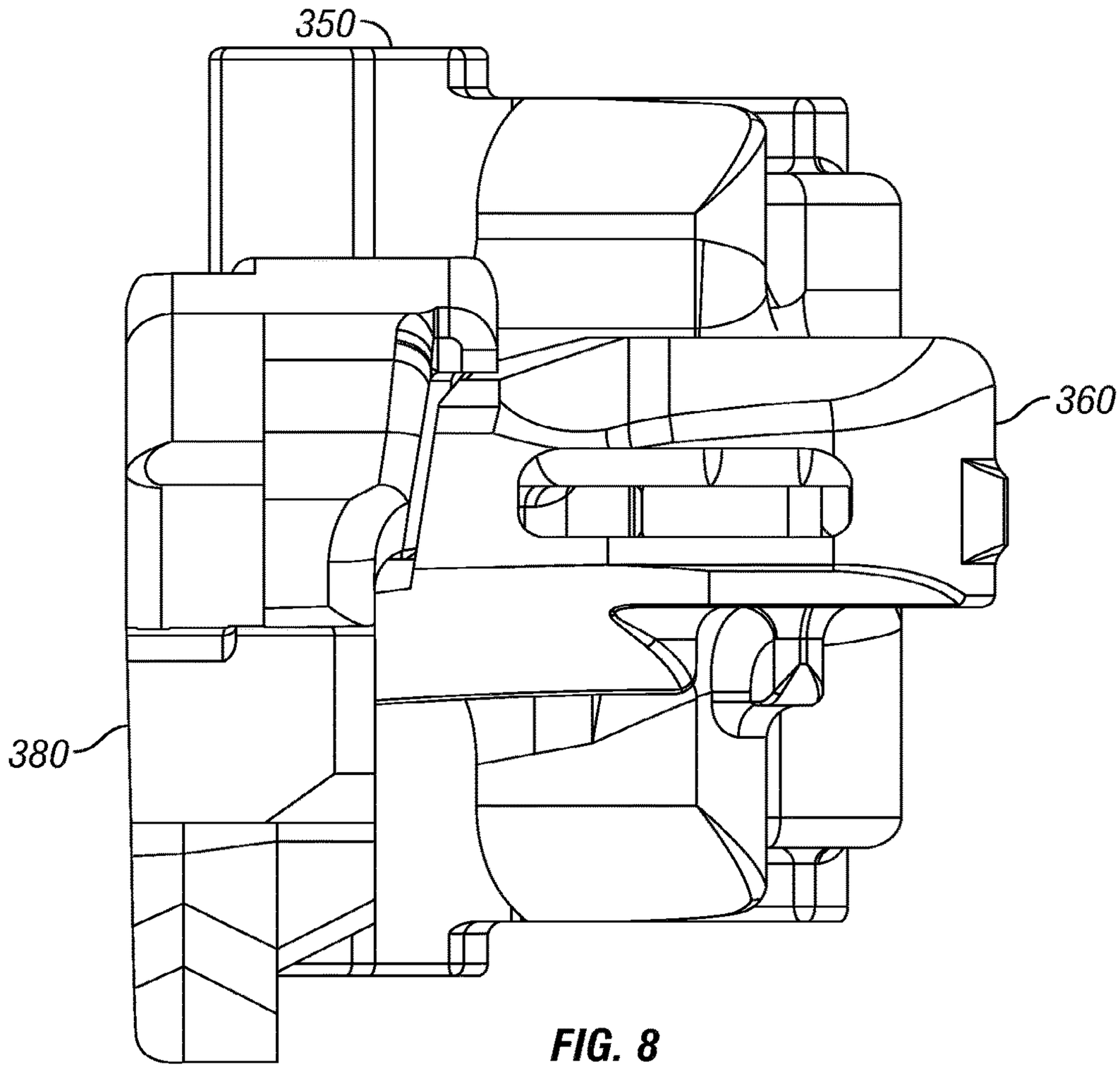

FIG. 8

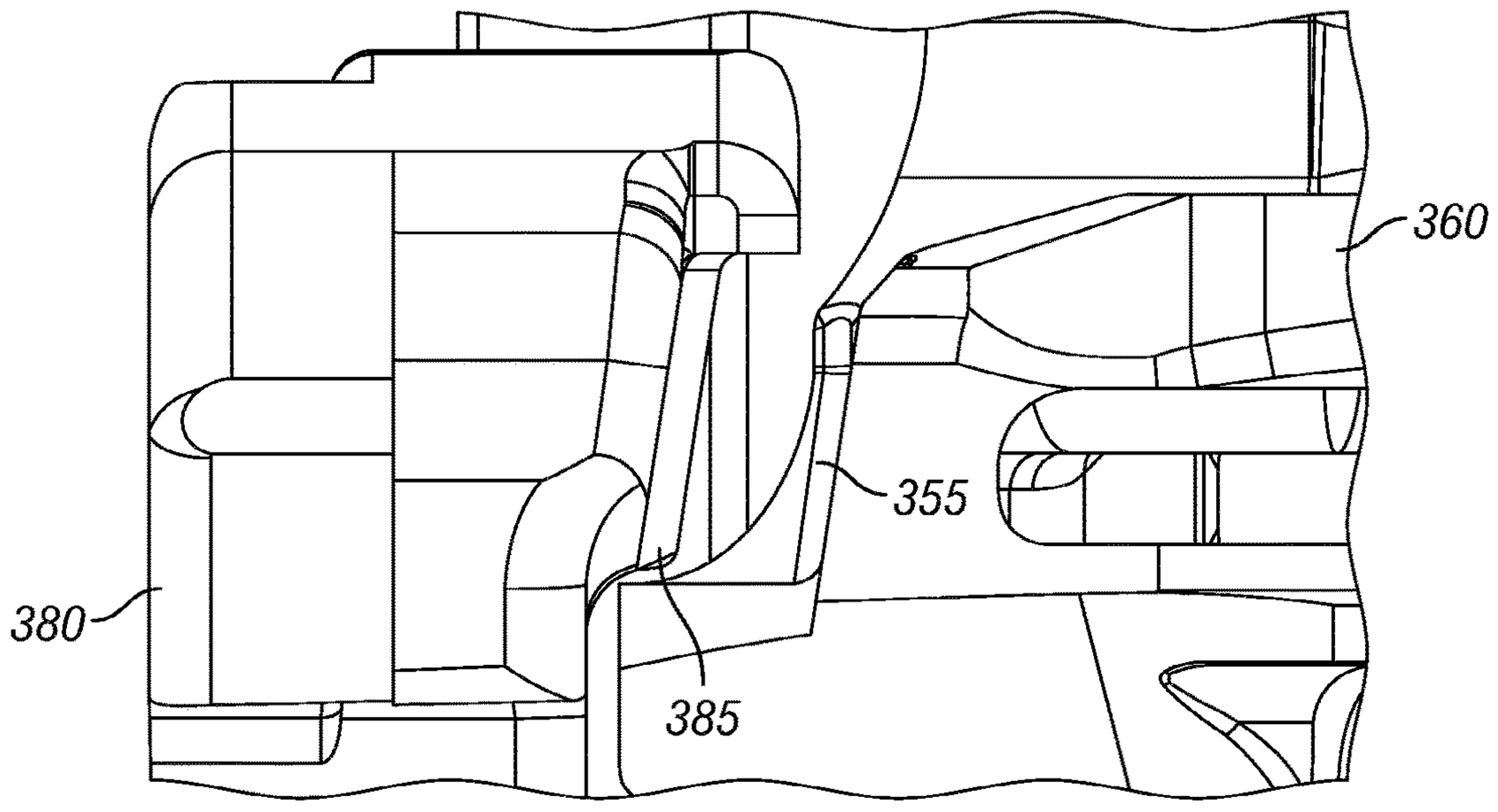

FIG. 9

RAILWAY CAR COUPLER AND KNUCKLE SYSTEM AND METHOD

PRIORITY INFORMATION

The present application is a U.S. National Stage Filing under 35 U.S.C. §371 of International Patent Application Serial No. PCT/US2014/026375 filed Mar. 13, 2014 and entitled "RAILWAY CAR COUPLER AND KNUCKLE SYSTEM AND METHOD" and claims benefit of U.S. Provisional Application Ser. No. 61/793,859, filed Mar. 15, 2013, and incorporated by reference herein.

TECHNICAL FIELD

The present disclosure is related to railway car couplers, and more particularly to a railway car coupler and knuckle system and method.

BACKGROUND

Railcar couplers are disposed at each end of a railway car to enable joining one end of such railway car to an adjacently disposed end of another railway car. The engageable portions of each of these couplers is known in the railway art as a knuckle. For example, railway freight car coupler knuckles are taught in U.S. Pat. Nos. 4,024,958; 4,206,849; 4,605,133; and 5,582,307.

In many cases when a railcar knuckle fails, a replacement knuckle must be carried from the locomotive at least some of the length of the train, which may be up to 25, 50 or even 100 railroad cars in length. The repair of a failed coupler can be labor intensive, can sometimes take place in very inclement weather and can cause train delays.

SUMMARY

In accordance with a particular embodiment, a railway car coupler system includes a railcar coupler comprising a coupler head portion extending from a shank portion. The coupler head portion is configured to couple to a first coupler knuckle for coupling the railcar coupler to a second railcar coupler of an adjacent railcar. The coupler head portion comprises a coupler pivot pin hole for receiving a pivot pin for coupling the railcar coupler to the first coupler knuckle. The pivot pin hole has a longitudinal axis. The coupler head portion comprises top and bottom coupler pulling lugs each having a respective coupler pulling lug engagement face. At least one of the coupler pulling lug engagement faces of the top and bottom coupler pulling lugs is angled with respect to the longitudinal axis.

The at least one coupler pulling lug engagement face angled with respect to the longitudinal axis may be angled approximately 30 degrees from the longitudinal axis. The first coupler knuckle may comprise top and bottom knuckle pulling lugs for engaging with the top and bottom coupler pulling lugs, respectively. The top and bottom knuckle pulling lugs may each have a respective knuckle pulling lug engagement face. At least one of the knuckle pulling lug engagement faces of the top and bottom knuckle pulling lugs may be angled with respect to the longitudinal axis.

In accordance with another embodiment, a method includes casting a railcar coupler comprising a coupler head portion extending from a shank portion. The coupler head portion is configured to couple to a first coupler knuckle for coupling the railcar coupler to a second railcar coupler of an adjacent railcar. The coupler head portion comprises a coupler pivot pin hole for receiving a pivot pin for coupling the railcar coupler to the first coupler knuckle. The pivot pin hole has a longitudinal axis. The coupler head portion comprises top and bottom coupler pulling lugs each having a respective coupler pulling lug engagement face. At least one of the coupler pulling lug engagement faces of the top and bottom coupler pulling lugs is angled with respect to the longitudinal axis.

Technical advantages of particular embodiments include angled pulling lugs which facilitate distribution of load on both sets of pulling lugs even if only one makes contact during engagement. This is intended to prevent loading of only one set of pulling lugs in some circumstances. In addition, an increased distance between a pivot pin hole and pivot pin protector better ensures that the pivot pin is not loaded before the pulling lugs. Moreover, a mating geometry between a lock and a knuckle better ensures that the lock will move in place with the knuckle during coupler engagement.

Other technical advantages will be readily apparent to one of ordinary skill in the art from the following figures, descriptions, and claims. Moreover, while specific advantages have been enumerated above, various embodiments may include all, some, or none of the enumerated advantages.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete understanding of embodiments of the invention will be apparent from the detailed description taken in conjunction with the accompanying drawings in which:

FIG. **1** illustrates a railway car coupler head;

FIG. **2** illustrates coupler of FIG. **1** engaged with a knuckle;

FIG. **3** illustrates a coupler, in accordance with particular embodiments;

FIG. **4** illustrates a knuckle, in accordance with a particular embodiment;

FIG. **5** illustrates the coupler of FIG. **3** engaged with the knuckle of FIG. **4**, in accordance with a particular embodiment;

FIG. **6** illustrates a coupler engaged with the knuckle of FIG. **4**, in accordance with particular embodiments;

FIG. **7** illustrates a portion of a coupler, in accordance with particular embodiments; and

FIGS. **8** and **9** illustrate a coupler and a knuckle engaged with a lock, in accordance with particular embodiments.

DETAILED DESCRIPTION

Example embodiments and their advantages are best understood by referring to FIGS. **1** through **9** of the drawings.

FIG. **1** illustrates a railway car coupler head **10**. Railway car coupler head **10** may be part of a type E coupler, a type F coupler, a type EF coupler, or another type of coupler. A type E coupler head is illustrated. Coupler head **10** includes guard arm **14**. Opposite guard arm **14** is the knuckle side of coupler head **10**. Between the knuckle side and guard arm **14** is front face **12**.

Coupler head **10** may be configured to receive a knuckle. The knuckle may be received and retained in a pivotal manner with a pivot pin that extends through pivot pin holes **18** of pivot lugs **16**. The pin may be protected by pin protectors **20** when it extends through pivot pin holes **18** and a corresponding pin hole in the knuckle. Located behind

pivot lugs **16** are top buffing shoulder **22** and bottom buffing shoulder **24**. Together, top and bottom buffing shoulders **22** and **24** form a pocket for receiving the knuckle. Buffing shoulders **22** and **24** may receive the transferred load from an interfacing surface of a knuckle when the railway car experiences buff (pushing) motions.

Extending from a lower portion of coupler head **10** adjacent bottom buffing shoulder **24** is bottom pulling lug **26**. Extending from a top surface of coupler head **10** adjacent top buffing shoulder **22** is top pulling lug **28**. At least a portion of top pulling lug **28** may be generally aligned with a portion of bottom pulling lug **26**.

When a knuckle is assembled with coupler head **10**, pulling lugs **26** and **28** may engage corresponding pulling lug surfaces of the knuckle. This engagement may allow pulling lugs **26** and **28** to receive a transfer draft load from a corresponding knuckle of a mating coupler on an adjacent railcar.

The knuckle (and its identical counterpart on an adjacent coupler) may operate by contacting the guard arm of an adjacent coupler. In a joining operation, the knuckle of coupler head **10** and the opposing knuckle may each pivot inward to a degree sufficient to lock the two knuckles in place behind each other so that coupler head **10** is properly joined with the adjacent coupler. A lock member slidably disposed within each coupler head **12** may be activated by the engagement to slide downward within the coupler head **10** and lock the knuckle in place to thereby join the two railway couplers together.

FIG. **2** illustrates coupler **10** of FIG. **1** engaged with a knuckle **50**. Knuckle **50** includes top knuckle pulling lug **52** and bottom knuckle pulling lug **54**. As evident from the figure, these knuckle pulling lugs include engagement faces that engage with engagement faces of top and bottom coupler pulling lugs **28** and **26**. Also shown is a longitudinal axis **19** of pivot pin hole **18** of coupler **10**. In conventional couplers and knuckles as shown, each of these engagement faces is substantially vertical, or substantially parallel to longitudinal axis **19** of pivot pin hole **18**. One problem with the vertical orientation of the pulling lugs is that if misalignment between the coupler and knuckle occurs or if one or more of the pulling lugs wears sufficiently then when the coupler is coupled to another coupler of an adjacent car only one set of pulling lugs may make contact and engage (e.g., top coupler pulling lug **28** with top knuckle pulling lug **52** or bottom coupler pulling lug **26** with bottom knuckle pulling lug **54**). If this occurs, then the load will transfer to only one set of the pulling lugs.

FIG. **3** illustrates a coupler **110**, in accordance with particular embodiments. Coupler **110** includes top coupler pulling lug **128** and bottom coupler pulling lug **126**, both with engagement faces which are angled from the vertical. For example, both are angled with respect to longitudinal axis **119** of pivot pin hole **118**. Reference numeral **129** shows the angle of the engagement face of top coupler pulling lug **128** with respect to the vertical, and reference numeral **127** shows the angle of the engagement face of bottom coupler pulling lug **126** with respect to the vertical. Angles **129** and **127** may be any suitable angle to one of ordinary skill in the art. In some embodiments, angles **129** and **127** may be approximately 30 degrees. In some embodiments, angle **129** may be a different angle than angle **127**. Particular embodiments may include a coupler with only one of the engagement faces of the top or bottom coupler pulling lugs at an angle with respect to the vertical.

FIG. **4** illustrates a knuckle **150**, in accordance with a particular embodiment. Knuckle **150** includes top knuckle pulling lug **152** and bottom knuckle pulling lug **154**. Engagement faces of both top and bottom knuckle pulling lugs **152** and **154** are, like top and bottom coupler pulling lugs **126** and **128** of coupler **110** of FIG. **3**, angled with respect to the vertical. For example, both are angled with respect to longitudinal axis **161** of pivot pin hole **162**, which may be referred to as a slotted pivot pin hole. The angles with respect to vertical of top and bottom knuckle pulling lugs **152** and **154** may be any suitable angle to one of ordinary skill in the art. In some embodiments, such angles may be approximately 30 degrees. In some embodiments, such angle of top knuckle pulling lug **152** may be a different from such angle of bottom knuckle pulling lug **154**. Particular embodiments may include a knuckle with only one of the engagement faces of the top or bottom knuckle pulling lugs at an angle with respect to the vertical.

FIG. **5** illustrates coupler **110** of FIG. **3** engaged with knuckle **150** of FIG. **4**, in accordance with a particular embodiment. Engagement faces of coupler pulling lugs **128** and **126** and of knuckle pulling lugs **152** and **154** are all angled with respect to the vertical. For example, each is angled with respect to a longitudinal axis of slotted pivot pin hole **118**. Having angled pulling lugs facilitates more even distribution of load. For example, if during railcar coupling only one set of pulling lugs makes contact (e.g., top coupler pulling lug **128** with top knuckle pulling lug **152** or bottom coupler pulling lug **126** with bottom knuckle pulling lug **154**), then one pulling lug will ride up such that load is distributed on the other set of pulling lugs that did not originally make contact with each other. Thus, if the respective bottom pulling lugs are loaded first, their angled configuration will ensure that both sets of pulling lugs will load.

The engagement faces of top coupler pulling lug **128** and top knuckle pulling lug **152** may include gap distances **131** and **133** between them at initial assembly. In particular embodiments, the coupler and knuckle and their respective pulling lugs may be configured such that gap distances **131** and **133** are approximately 1/16" or less. Such a small distance reduces the chance for shock loading as a result of the small distance of travel of the pulling lugs. Gap distances **131** and **133** may be different in particular embodiments. In particular embodiments, gap distance **131** may be approximately 0.0612", and gap distance **133** may be approximately 0.0294".

Couplers and knuckles of particular embodiments may be manufactured through a casting process with steel or other alloy. Typically one or more cores are used in the manufacturing process in order to form various cavities in the coupler and knuckle. The cores are typically made of resin or otherwise hardened sand. Specifically, the coupler and/or knuckle may each be produced in a mold cavity within a casting box between cope and drag sections. Sand, such as green sand, is used to define the interior boundary walls of the mold cavity. The mold cavity may be formed using a pattern and may include a gating system for allowing molten alloy to enter the mold cavity. The mold cavities define the exterior surfaces of the coupler and knuckle. The cores used to form cavities are placed at appropriate locations within the mold cavity. Once the coupler and/or knuckle is cast, the sand or resin cores may be removed leaving the cavities. The coupler and knuckle may each undergo a metal finishing process that includes finishing the surfaces of the coupler and knuckle.

FIG. **6** illustrates coupler **10** engaged with knuckle **150**, in accordance with particular embodiments. Coupler **10**

includes top knuckle pulling lug **28** and bottom knuckle pulling lug **26**, each having engagement faces substantially parallel to vertical. Knuckle **150** includes top coupler pulling lug **152** and bottom coupler pulling lug **154**, each having engagement faces angled with respect to vertical. In particular embodiments, a knuckle with one or more angled pulling lugs can be used with a coupler having one or more substantially vertical pulling lugs.

FIG. **7** illustrates a portion of a coupler **250**, in accordance with particular embodiments. Coupler **250** includes a hub portion with pivot pin protector wall **270** and slotted pivot pin hole **260**. In conventional couplers, a pivot pin protector wall may be closer to the pivot pin hole than what is shown in certain locations. However, in particular embodiments, the pivot pin protector wall may be elongated as illustrated with respect to pivot pin protector wall **270**. The elongated shape of pivot pin protector wall **270** increases the distance between slotted pivot pin hole **260** and the pivot pin protector wall to ensure that, as a result of the angled pulling lugs of particular embodiments, the pivot pin protector wall is not loaded first and instead the pulling lugs are loaded first during coupler engagement. In particular embodiments, distance **275** between a center of slotted pivot pin hole **260** and the general portion of pivot pin protector wall **270** shown may be approximately 2.17 inches.

In particular embodiments, slotted pivot pin hole **260** may be elongated as illustrated. Slotted pivot pin hole **260** may provide advantages when using a conventional coupler and a knuckle with angled pulling lugs of particular embodiments. For example, slotted pivot pin hole **260** may minimize additional load that might be placed on a pivot pin when angled pulling lugs of particular embodiments are used with a conventional coupler.

FIGS. **8** and **9** illustrate a coupler **350** and a knuckle **360** engaged with a lock **380**, in accordance with particular embodiments. As illustrated, portions of lock **380** and knuckle **360** that engage each other, lock portion **385** and knuckle portion **355**, are beveled. In particular embodiments, such beveling may be approximately 8 degrees. Beveling these portions helps them to self-center during engagement. In addition, a boss or protrusion is added to the lock portion or the knuckle portion, and corresponding geometry is provided on the other portion. The angled pulling lugs of particular embodiments cause more longitudinal movement during engagement, which is desired. However, one would not want the knuckle to move relative to the lock as a result of the greater longitudinal movement. Friction may cause the lock to stay where it is relative to the knuckle. With the illustrated mating geometry of lock **380** and knuckle **360**, lock **380** will move in place with knuckle **360** as desired.

As described, technical advantages of particular embodiments include angled pulling lugs which facilitate distribution of load on both sets of pulling lugs even if only one makes contact during engagement. This prevents loading of only one set of pulling lugs in some circumstances. In addition, an increased distance between a slotted pivot pin hole and pivot pin protector better ensures that the pivot pin is not loaded before the pulling lugs. In particular embodiments, a mating geometry between a lock and a knuckle better ensures that the lock will move in place with the knuckle during coupler engagement.

Although the present invention and its advantages have been described in detail, it should be understood that various changes, substitutions, and alterations can be made therein without departing from the spirit and scope of the invention as defined by the appended claims.

What is claimed is:

1. A railway car coupler system, comprising:

a railcar coupler comprising:

a coupler head portion extending from a shank portion, the coupler head portion configured to couple to a first coupler knuckle for coupling the railcar coupler to a second railcar coupler of an adjacent railcar;

the coupler head portion comprising a coupler pivot pin hole for receiving a pivot pin for coupling the railcar coupler to the first coupler knuckle, the pivot pin hole having a longitudinal axis; and

the coupler head portion comprising top and bottom coupler pulling lugs each having a respective coupler pulling lug engagement face, wherein at least one of the coupler pulling lug engagement faces of the top and bottom coupler pulling lugs is angled with respect to the longitudinal axis.

2. The railway car coupler system of claim **1**, wherein:

the first coupler knuckle comprises top and bottom knuckle pulling lugs for engaging with the top and bottom coupler pulling lugs, respectively;

the top and bottom knuckle pulling lugs each has a respective knuckle pulling lug engagement face; and

at least one of the knuckle pulling lug engagement faces of the top and bottom knuckle pulling lugs is angled with respect to the longitudinal axis.

3. The railway car coupler system of claim **2**, wherein a width of a gap between the coupler pulling lugs and the knuckle pulling lugs is approximately 1/16" or less at initial coupling of the railcar coupler and the first coupler knuckle.

4. The railway car coupler system of claim **2**, further comprising a lock, wherein an engagement face of the knuckle that engages an engagement fact of the lock is angled with respect to a vertical axis.

5. The railway car coupler system of claim **4**, wherein the engagement face of the knuckle is angled at approximately 8 degrees from the vertical axis.

6. A railway car coupler system, comprising:

a railcar coupler knuckle comprising a tail section, a hub section, and a front face section, the railcar coupler knuckle configured to couple to a first railcar coupler for coupling the first railcar coupler to a second railcar coupler of an adjacent railcar;

the hub section comprising a pivot pin hole for receiving a pivot pin for coupling the railcar coupler knuckle to a first railcar coupler, the pivot pin hole having a longitudinal axis;

the railcar coupler knuckle comprising top and bottom knuckle pulling lugs each having a respective knuckle pulling lug engagement face; and

wherein at least one of the knuckle pulling lug engagement faces of the top and bottom knuckle pulling lugs is angled with respect to the longitudinal axis.

7. The railway car coupler system of claim **6**, wherein:

the first railcar coupler comprises a coupler head portion extending from a shank portion;

the coupler head portion comprises top and bottom coupler pulling lugs for engaging with the top and bottom knuckle pulling lugs, respectively;

the top and bottom coupler pulling lugs each has a respective coupler pulling lug engagement face; and

at least one of the coupler pulling lug engagement faces of the top and bottom coupler pulling lugs is angled with respect to the longitudinal axis.

8. The railway car coupler system of claim **7**, wherein a width of a gap between the coupler pulling lugs and the

knuckle pulling lugs is approximately 1/16" or less at initial coupling of the railcar coupler and the first coupler knuckle.

9. The railway car coupler system of claim **6**, wherein:

the first railcar coupler comprises a coupler head portion extending from a shank portion;

the coupler head portion comprises top and bottom coupler pulling lugs for engaging with the top and bottom knuckle pulling lugs, respectively;

the top and bottom coupler pulling lugs each has a respective coupler pulling lug engagement face; and

the coupler pulling lug engagement faces of the top and bottom coupler pulling lugs are substantially parallel to the longitudinal axis.

10. The railway car coupler system of claim **6**, further comprising a lock, wherein an engagement face of the knuckle that engages an engagement fact of the lock is angled with respect to a vertical axis.

11. The railway car coupler system of claim **10**, wherein the engagement face of the knuckle is angled at approximately 8 degrees from the vertical axis.

12. A method, comprising:

casting a railcar coupler comprising:

a coupler head portion extending from a shank portion, the coupler head portion configured to couple to a first coupler knuckle for coupling the railcar coupler to a second railcar coupler of an adjacent railcar;

the coupler head portion comprising a coupler pivot pin hole for receiving a pivot pin for coupling the railcar coupler to the first coupler knuckle, the pivot pin hole having a longitudinal axis; and

the coupler head portion comprising top and bottom coupler pulling lugs each having a respective coupler pulling lug engagement face, wherein at least one of the coupler pulling lug engagement faces of the top and bottom coupler pulling lugs is angled with respect to the longitudinal axis.

13. The method of claim **12**, wherein:

the first coupler knuckle comprises top and bottom knuckle pulling lugs for engaging with the top and bottom coupler pulling lugs, respectively;

the top and bottom knuckle pulling lugs each has a respective knuckle pulling lug engagement face; and

at least one of the knuckle pulling lug engagement faces of the top and bottom knuckle pulling lugs is angled with respect to the longitudinal axis.

14. The method of claim **13**, wherein a width of a gap between the coupler pulling lugs and the knuckle pulling lugs is approximately 1/16" or less at initial coupling of the railcar coupler and the first coupler knuckle.

* * * * *